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200 kW B Anaerobic Digester System

ABSTRACT

More than 90% of the wastewater treatment plants (WWTPs) in the United States generate anaerobic digester gas (ADG) as a by-product of their operation. ADG is a mixture of gases, mainly methane (generally 60%) and carbon dioxide. When ADG is released uncombusted, it contributes significantly to the greenhouse effect, as methane traps 10 to 20 times more heat than carbon dioxide does. Therefore, excess ADG is typically flared in flame towers. However, flaring is only a partial solution, since ADG combustion generates photoreactive ozone precursors such as nitric oxides (NOx) and volatile organic compounds (VOC). As a result, WWTPs are regulated as stationary sources of air pollution under the Clean Air Act. WWTPs situated in heavily urbanized areas in severe ozone non-compliance areas such as Southeastern New York State and emitting in excess of 25 tons/year of NOx and VOC are designated and regulated as major sources. This designation requires installation of extensive control and monitoring technologies. The Authority serves at least 14 WWTPs in New York City and Westchester County that fall into this category.

Fuel cells (FCs) provide effective solutions to these problems by efficiently generating premium quality electricity and much-needed heat while consuming ADG and emitting orders-of-magnitude smaller amounts of NOx and VOC. Additionally, integration of FCs with an inexpensive or free renewable fuel resource such as ADG could be a major step in reducing FCPP electricity costs and expediting commercialization of FC technology.

Many of the Authority s WWTP customers could be equipped with multiple FC power plants (FCPPs) with a capacity of approximately 200 kW at each site. Total production potential is estimated at between 5 and 10 MW. FCs have a potential to generate valuable emission credits, assure compliance with present and future Clean Air Act requirements, and substantially reduce air pollution from WWTP flares in Southeastern New York State. This would be an important service to wastewater treatment customers, reducing their operating costs and regulatory burdens. The FC program would also benefit New York State industries, since New York companies would manufacture at least 29% of the equipment.

In its first FC project, the Authority is joining forces with Westchester County to install a FCPP at the Yonkers Joint Wastewater Treatment Plant. The U.S. Department of Energy (US DOE) the New York State Energy Research and Development Authority and the Electric Power Research Institute have helped the Authority to develop and finance the project, which is the first installation of its kind nationally. The project received the $200,000 grant # DE-FG21-96MC33354 from the US DOE Climate Change Fuel Cell Program administered by Morgantown Energy Technology Center officers Ms R. Diane Manilla and Ms Diane Hooie. International Fuel Cells Corporation (IFC) manufactured the FCPP of Connecticut. It commenced operation in April, 1997. The standard IFC PC25C power plant was modified to accept a lower BTU ADG and to pass through up to 40% of carbon dioxide. Also, an ADG pretreatment system to remove water, sulfur bearing compounds, and halogens was developed with the US DOE assistance.

ADG is partially utilized and partially flared at the Yonkers Joint Sewage Treatment Plant. An FCPP captures a portion of the otherwise flared ADG, use it as fuel and produce approximately 200 kW of electricity and an ample amount of heat for various uses at the host plant. One or two more fuel cells could be installed at this site in the future to capture 100% of the otherwise wasted ADG.

Potential FC benefits extend far beyond WWTPs. FC development is reaching its maturing status at a time of emerging deregulation in the electric utility industry. FCs offer high efficiency, very low emissions, available thermal energy, fuel flexibility, potential mobility and premium quality electricity in distributed generation applications. FCs may allow the Authority to reach customers directly, bypassing competitors distribution systems and avoiding their delivery charges. For these reasons, the Authority is gaining hands-on operating experience and assessing the role FCs may play in distributed generation applications and in the rapidly unfolding competitive energy markets.

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